

Remarks

The present amendment is in response to the Official Action mailed on November 4, 2002, in which Claims 1-19 are rejected under 35 U.S.C. 102 (e), and Claims 20-28 are rejected under 35 U.S.C. 103(a). Moreover, Claims 20-28 are rejected under 35 U.S.C. 112. Applicant has thoroughly reviewed the outstanding Office Action including the Examiner's Actions and the references cited therein. The following remarks are believed to be fully responsive to the Office Action and, when coupled with the above amendments, are believed to render all claims at issue patentably distinguishable over the cited references.

Applicant respectfully requests reconsideration in light of the above amendments and the following remarks.

CLAIM AMENDMENTS – IN GENERAL

In brief, the main substantive changes to the claims include the amended recitation of independent Claim 20. The changes have been made for clarification and are supported by the drawings as originally filed. It is respectfully submitted that no new matter is added to Claim 20 by these changes.

It is respectfully submitted that these changes are clearly supported by the description of the application, and therefore do not constitute any new matter.

CLAIM REJECTIONS- 35 U.S.C. SECTION 102 (e)

With respect to Page 2 through Page 3 of the Office Action, the Examiner rejected Claims 1-19 under 35 U.S.C. Section 102 (e) as being anticipated by US patent 6,163,050 Hisatomi et al..

Applicant respectfully traverses these rejections.

According to this Office Action, the Examiner is of the opinion that Hisatomi et al. disclose a gas comprising silane (referring to column 6 line 40). Thus, the Examiner is of the opinion that the present invention is disclosed by the disclosure of Hisatomi et al., and Applicant's argument about the material in the previous response is improper.

However, in Hisatomi's disclosure, the illustration is "... Then, **dichloro silane gas** (gas flow: 90 sccm) and N₂O gas (gas flow: 180 sccm) are reacted with each other under conditions that reaction temperature is 780°C and pressure is 0.1 Torr by low-pressure CVD, thereby forming the silicon oxide film 36-1 having a thickness of 60 Å. ... " (column 6 lines 40-45). That is, **in Hisatomi's disclosure, the silicon oxide films are made of dichlorosilane (SiH₂Cl₂), not silane (SiH₄), and the silicon oxide film would comprise Cl. In the present invention, the silicon oxide layer is made of silane, not dichloro silane. Silane is different from dichloro silane.** Thus, the manufacturing and the result of the silicon oxide layers of this present invention are different from those of the silicon oxide films of Hisatomi's disclosure.

Besides, as mentioned in Hisatomi's disclosure, **both of the first CVD silicon oxide film 36-1 and the second CVD silicon oxide film 36-2 comprise Cl whose concentration is more than 1×10^{18} atoms/cm³ and less than 2×10^{20} atoms/cm³**(column 3 lines 24-26, column 6 lines 23-28), and thus the insulation breakdown voltage of the silicon oxide film can be prevented from being reduced by BMD (Bulk Micro Defect) and the breakdown voltage can be improved (see column 3 lines 26-30). In other words, **in Hisatomi's disclosure, the silicon oxide films with Cl are very important and could not be ignored.** However, **in this invention, during forming the silicon oxide layer, silane, not dichloro silane, is employed as the material of the silicon oxide layer.** That is, the manufacture of the silicon oxide layer of this present Application introduces the gas comprising silane, and is different from the manufacture of the silicon oxide film of Hisatomi's disclosure introducing gas including dichloro silane. Hence, this Application cannot be taught by Hisatomi's disclosure.

Moreover, this present Application is employed for forming the semiconductor structure in one chamber. For growing the semiconductor structure, as known by one of ordinary skill in the art, **the growing rate of SiH_2Cl_2 is slower than the growing rate of SiH_4 . The growing rate of SiH_4 is about 15 times faster than the growing rate of SiH_2Cl_2 .** Therefore, if SiH_2Cl_2 is used in the process disclosed in this present Application instead of SiH_4 , the manufacture time of the semiconductor structure will be extended. It is not efficient for forming the semiconductor structure mentioned in this present Application. Besides, **when using SiH_2Cl_2 as the material for forming the semiconductor structure, some side products, such as NH_4Cl or others, will be formed as particles in the process.** The above-mentioned particles of the side products will

cause defects in the manufacture of the semiconductor structure.
Hence, SiH_2Cl_2 is not proper for using in the manufacture of this present Application.

According to this and the previous Office Action, the Examiner seemingly misunderstands the invention in comparing this present Application with Hisatomi's disclosure. According to the above-mentioned explanation, **the method for manufacturing an ONO structure of Hisatomi's disclosure is different from the method disclosed in this present Application.** That is, the difference between the cited reference and the present invention is non-obvious. Furthermore, the citation does not disclose or suggest the purposes and features of the present invention. In view of the foregoing, the features of the present invention are patently distinguishable from the cited reference. A rejection, which ignores the purposes of the prior art in the manner that an ordinary artisan would have perceived them, is not proper, as explained in MPEP 2143.01. On the other hand, a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), 469 U.S. 851(1984).

Obviously, for the foregoing reasons, it is believed that there is no reason, suggestion, or motivation in the cited prior art, whereby a person of ordinary skill would not modify the citation as set forth in this office action by any citation to perform the process of the present invention. For these reasons, and for the reasons discussed previously, it is respectfully submitted that citation as stated by the examiner does not anticipate Claims 1-19 of this present Application

and withdrawal of the rejection under 35 U.S.C. §102(e) is respectfully requested.

CLAIM REJECTIONS- 35 U.S.C. SECTION 103

With respect to Page 3 through Page 5 of the Office Action, the Examiner rejected Claims 20-22, 25 and 27-28 under 35 U.S.C. 103 (a) as being unpatentable over Hisatomi et al. (U.S. patent No. 6,163,050) in view of Yamazaki et al. (U.S. patent No. 6,323,142), and rejected Claims 23, 26 under 35 U.S.C. 103 (a) as being unpatentable over Hisatomi et al. (U.S. patent No. 6,163,050) in view of Laxman et al. (U.S. patent No. 5,976,991).

The Examiner is of the opinion that Hisatomi does not expressly disclose the first oxide layer not includes Cl, and wherein the first and second oxide layers are formed by introducing silane gas and nitrogen gas. However, Yamazaki discloses the oxide layer not including Cl. Therefore, it would have been obvious to one of ordinary skill in the art to use the oxide film of Yamazaki with the method of Hisatomi to achieve the Claims 20-22, 25 and 27-28 of this present Application.

The Examiner is also of the opinion that Hisatomi does not expressly disclose the method wherein the first and second buffer layer is formed by introducing silane, nitrogen oxide, and ammonia. However, ²Laxman discloses the buffer layer formed by introducing silane, nitrogen oxide, and ammonia. Therefore, it would have been obvious to one of ordinary skill in the art to use silane, nitrogen oxide,

and ammonia to form SiON teaching of Yamazaki with the method of Hisatomi to achieve the Claims 23 and 26 of this present Application.

Applicant respectfully traverses these rejections.

Yamazaki discloses a method for forming a film containing hydrogen and nitrogen which film is low in the content of carbon components and superior both in step coverage and impurity blocking performance. In Yamazaki's disclosure, **hydrogen (21a) was used as the decarbonization source gas (21)**, wherein **active hydrogen such as hydrogen radicals and hydrogen ions gasify carbon by reacting with it and forming CH_x** (column 7 lines 24-36). The decarbonization process is a key point of Yamazaki's disclosure and should not be ignored.

Laxman discloses a method for forming silicon oxide and silicon oxynitride films **using bis(tertiary butylamino)silane (BTBAS) as an organo-silicon source material**. In Laxman's disclosure, **Laxman employs BTBAS instead of silane and dichlorosilane** because of the following reasons: (i) silane and dichlorosilane are pyrophoric, toxic compressed gases; (ii) Oxide depositions with dichlorosilane require very high temperatures and have very low deposition rates. The films may contain chlorine and there is a significant particle contamination problem; and (iii) Films formed using silane are not dense and are hygroscopic. This process requires expensive "caged boats" to obtain usable deposited film uniformities. Small deviations in oxygen to silane ratios may produce homogeneous reactions that will produce significant particle contamination. (column 1 lines 44-56)

If the combination of Hisatomi's method and the oxide film teaching of Yamazaki is possible, as mentioned in this Office Action, the combination result closest to this present Application might be a method including: forming a first silicon oxide film by introducing organic silane gas, oxidizing gas, and hydrogen radical into a reaction chamber; forming a first SiON film on the first silicon oxide film; forming a SiN film on the SiON film; forming a second SiON film on the SiN film; and forming a second Silicon oxide film on the second SiON film. In the above-mentioned result, **the first and second silicon oxide films are formed by introducing silane gas, oxidizing gas, and hydrogen radical.** According to the Examiner's viewpoint, the above-mentioned result discloses a modified method of Hisatomi without Cl in the oxide films by the teaching of Yamazaki. However, according to Yamazaki's disclosure, **during the manufacturing of the oxide film, active hydrogen, such as hydrogen radicals and hydrogen ions, has to be employed for decarbonization.** However, **in this present Application, active hydrogen does not be used during the oxide layer formation.** Hence, this present cannot be taught by the combination of the disclosures of Hisatomi and Yamazaki.

On the other hand, if the combination of the SiON film formation teaching of Laxman and Hisatomi's method is possible, the predictable combination result which is closest to this present Application might be including: forming a first silicon oxide film on a polysilicon layer; forming a first SiON film on the first silicon oxide film; forming a SiN film on the first SiON film; forming a second SiON film on the SiN film; and forming a second silicon oxide film on the second SiON film. **The above-mentioned SiON films are made of**

BTBAS, N₂O, and NH₃. However, in this present Application, SiON layer is formed of silane, N₂O, and NH₃. BTBAS [bis(tertiarybutylamino)sinane] is different from silane in both chemical and physical character, and thus the manufacturing of the SiON film in the above-mentioned combination result and that in this present Application is different. Thus, this present Application cannot be taught by the combination of the disclosure of Hisatomi and Laxman.

As mentioned in the foregoing discussion, according to the cited references and figures thereof, the purposes disclosed in this invention is not achieved or accomplished by combining the processes of cited references from each other. Moreover, the court reversed the rejection holding " suggested combination of references would require a substantial reconstruction and redesign of the elements shown in the primary reference as well as a change in the basic principle under which the primary reference construction was designed to operate." 123 USPQ at 352. Hence, the differences between the cited references and the present invention are non-obvious. So, Hisatomi, Yamazaki, and Laxman's disclosures do not disclose or suggest the purposes and features of the present invention. In view of the foregoing, the features of the present invention are patently distinguishable from the cited references. It is respectfully submitted that one of ordinary skill in the art could only have used hindsight to make the proposed modification. A rejection, which ignores the purposes of the prior art in the manner that an ordinary artisan would have perceived them, is not proper, as explained in MPEP 2143.01. Furthermore, reference to the prior art must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), 469 U.S. 851 (1984).

Therefore, for these reasons and the reasons discussed above, the applicant respectfully submits that the claims of this invention are patently distinguished over the cited references of Hisatomi, Yamazaki, and Laxman. Reconsideration and withdrawal of the rejection under 35 U.S.C. Section 103 is respectfully requested.

MARKED-UP CHANGES

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached paper is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Conclusion

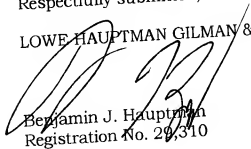
In the light of the above amendments and remarks, Applicant respectfully submits that all pending Claims 1-28 as currently presented are in condition for allowance. Applicant has thoroughly reviewed that art cited but relied upon by the Examiner. Applicant has concluded that these references do not affect the patentability of these claims as currently presented. Accordingly, reconsideration is respectfully requested.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension

of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,

LOWE HAUPTMAN GILMAN & BERNER, LLP

A large, stylized handwritten signature in black ink, appearing to read 'B. J. Hauptman', is written over the printed name and registration number.

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IN THE CLAIMS:

Claim 20 is amended as follows:

20. (Amended) A method for forming an oxide-nitride-oxide structure in one chamber, the method comprising the steps of:

providing a substrate;

forming a first oxide layer on said substrate, wherein said first oxide layer includes no (not essentially) Cl;

forming a first buffer layer on said first oxide layer;

forming a silicon nitride layer on said first buffer layer;

forming a second buffer layer on said silicon nitride layer; and

forming a second oxide layer on said second buffer layer.